

Major Concept

- 20.1 Reproductive system of Man
- 20.2 Disorders of Reproductive System
- 20.3 Sexually Transmitted Diseases

Learning Outcomes

Students will be able to:

- Describe the structures of male reproductive system and identifying their functions.
- Explain the principal reproductive hormones of human male and explain their role in the maintenance and functioning of reproductive system.
- Explain the structures of female reproductive system and describe their functions.
- Describe the menstrual cycle emphasizing the role of hormones.
- Describe the causes of female and male infertility.
- Explain that *in vitro* fertilization (test tube babies) is one of the methods to solve the problem of infertility.
- Define miscarriage and state its causes.
- Relate miscarriage with abortion.
- Describe the causes, symptoms and treatment of gonorrhoea and syphilis.
- Explain AIDS as a worldwide sexually transmitted disease.

Introduction

Reproduction is the biological process by which organisms give birth or give rise to new organisms which may or may not be like their parents. It helps to continue their race. This is a fundamental process and seen in all organisms. Reproduction is important for survival and maintenance of all organisms. Without this process life would come to an end. A living organism does not need reproduction to survive, but as a species, they need this mechanism for continuity and to ensure that they are not extinct.

20.1 Reproductive System of Human

The reproductive system of human is different from all other systems of body in two ways.

- i) It becomes functional at the age of puberty while other systems are functional at birth or shortly after birth.
- ii) The other systems are almost similar but reproductive system is quite different in male and female human.

20.1.1 Male Reproductive System

The male reproductive system performs following main functions:

- i) To produce, maintain and transport semen (sperms + fluids).
- ii) To discharge semen within the female reproductive tract during **sexual intercourse**.
- iii) To produce and secrete male **sex hormones**, responsible for maintaining the male reproductive system.

Unlike the female reproductive system, most part of male reproductive system is located outside of the body *i.e.* **penis**, **scrotum**, and **testicles** (testes) while some parts *i.e.* vas deferens and associated glands like seminal vesicles, prostate gland and Cowper's gland are located inside the body. (Fig.20.1)

Testes

The testes (singular testis) are the male gonads. These are oval-shaped organs about the size of large olive seeds. These are located outside of body in scrotum. The scrotum is a large

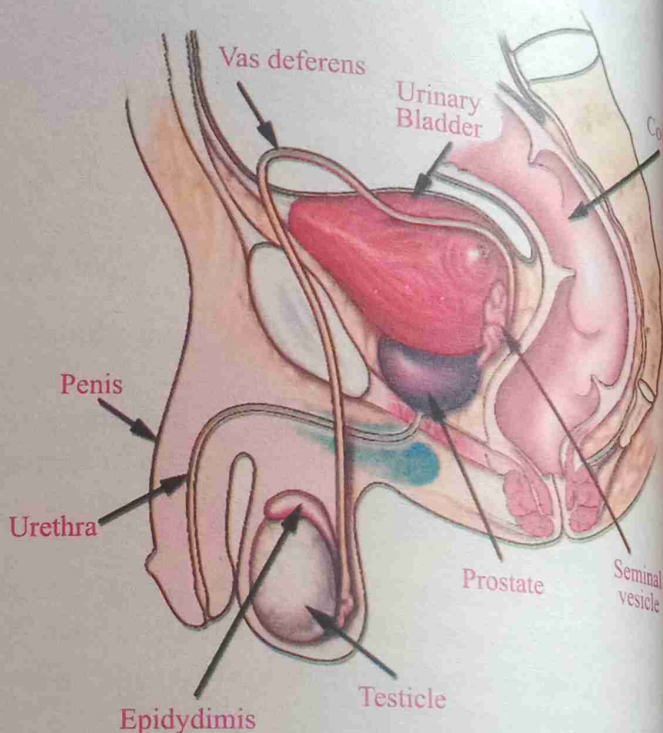


Fig. 20.1: Human Male Reproductive System

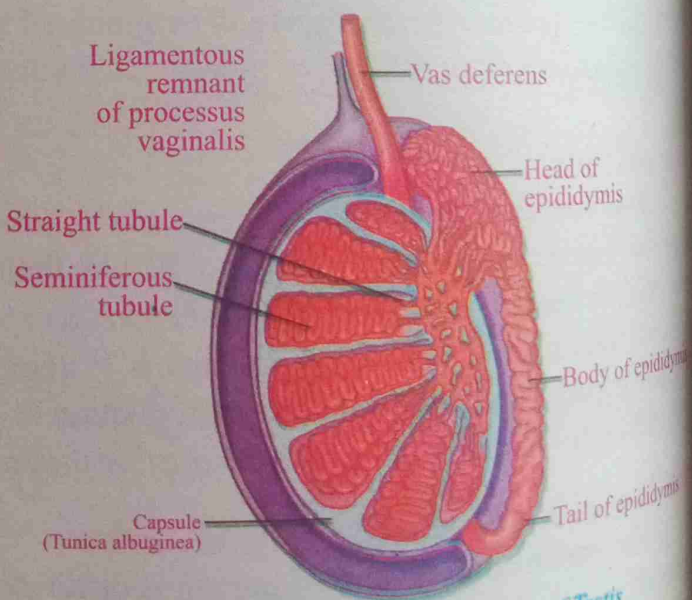


Fig. 20.2: Internal Structure of Testis

pouch like sac of skin that hangs behind and below the penis. The scrotum acts as climate control system for the testes, because for the normal sperm development, the testes must be at a temperature slightly cooler than the body temperature. The testes are usually two in number. In the testes there are coiled masses of tubules called **seminiferous tubules**. The sperms are produced in these tubules. The testes also produce male sex hormone called **testosterone** by leydig cells (interstitial cells). (Fig.20.2)

Accessory Ducts

These include the following:

Epididymis:- It is a long coiled tube that rests on the back side of each testis. It stores and transports sperms. Here sperms also get mature.

Vas deferens:- It is a long muscular tube that travels from epididymis into the pelvic cavity to just behind the bladder.

Ejaculatory ducts:- The two vas deferens and two seminal vesicles join to form ejaculatory duct. The ejaculatory ducts empty into urethra.

Urethra:- The urethra is the tube that carries urine from bladder to outside of the body. In male, it has the additional function of ejaculating semen during sexual excitement. Therefore, urethra is also called **urinogenital duct**.

Copulatory Organ (Penis)

It is the male organ used in sexual intercourse. The skin of penis is loose and elastic to accommodate changes in penis size during an erection. The penis consists mainly of tissues that can fill with blood to cause an erection.

Accessory Glands:- Following three types of glands are associated with male reproductive system.

Extra Information

About 100 million sperms are released into the vagina during intercourse, only one of these will fertilize the egg.

Human Sperm

The human sperm has a head with a diameter of about 2.5um. It contains a large nucleus with little cytoplasm and acrosome. The nucleus carries a haploid set of chromosomes. The middle piece containing mitochondria which provide energy for sperm activity. The tail of sperm is a flagellum which enables the sperm to swim towards the egg.

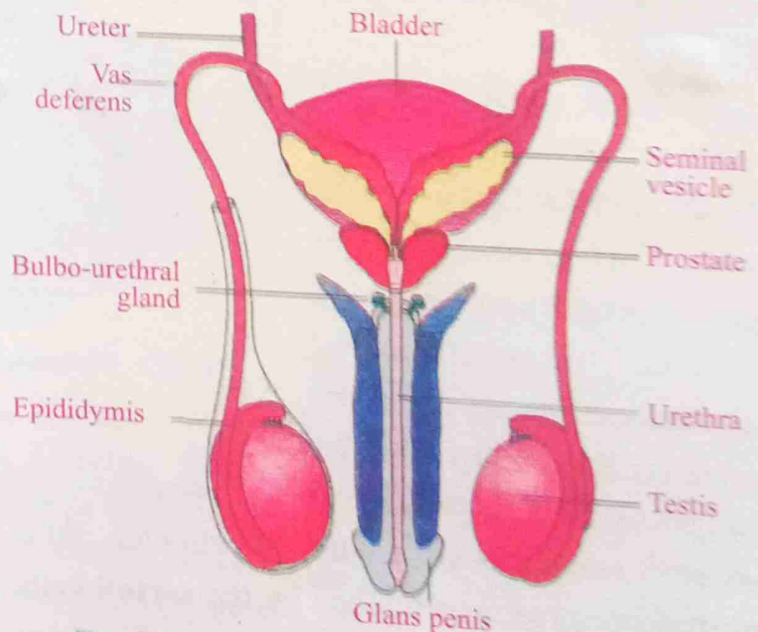


Fig. 20.3: Male Reproductive Organs (Front View)

Seminal Vesicle:- These are sac like pouches that attached to vas deferens near the base of the bladder. It produces a sugar rich fluid that provides sperms with a source of energy to help them move. (Fig.20.3)

Prostate glands

These are walnut size structure that are located below the urinary bladder at both side of urethra. The prostate gland contributes additional fluid to ejaculate, to nourish and protect the sperms.

Bulbourethral glands (Cowper's gland)

These are pea sized structures located on the side of urethra, just below the prostate glands. These glands produce a clear, slippery fluid which serves to lubricate and neutralize any acidity in urethra.

Hormonal Control of Male Reproductive Function

The entire male reproductive system is dependent on hormones. The primary hormones which involved in the functioning of the male reproductive system are: Follicle Stimulating Hormone (FSH), Luteinizing Hormone (LH) and testosterone. (Fig.20.4)

FSH and LH are produced by the pituitary gland located at the base of the brain. FSH is necessary for sperm production and LH stimulates the production of testosterone by Leydig cells, which is necessary to continue the process of **spermatogenesis**. Testosterone also helps in the development of male characteristics, including mass and strength, fat distribution, bone mass and sex drive.

Inhibin hormone is produced by the **sertoli cells** and controls the spermatogenesis at normal rate.

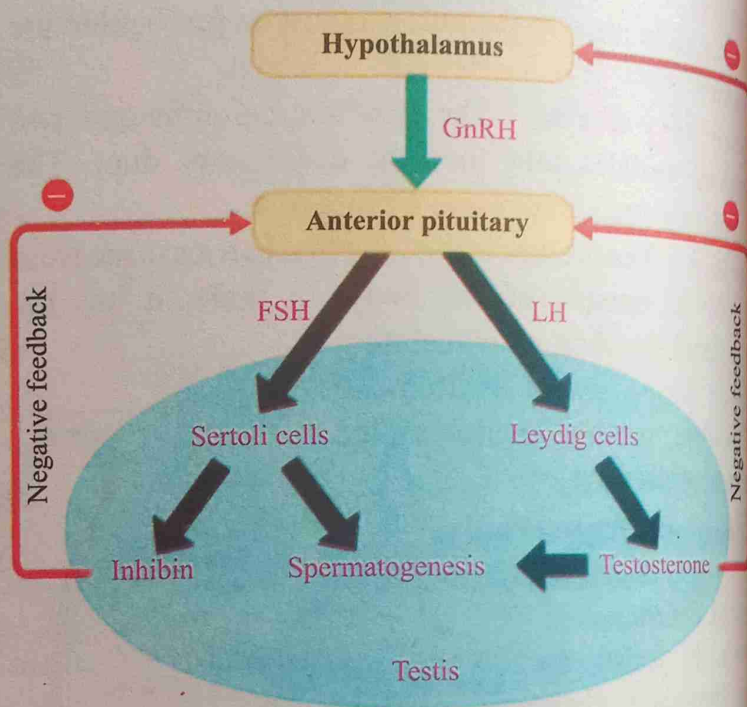


Fig.20.4: Hormonal Control of Male Reproductive System

20.1.2 Female Reproductive System

The female reproductive system is more complex than the male reproductive system, because the male needs only to produce and deliver gametes. However, female reproductive system besides producing gametes also gestates, gives birth and nourishes the new born. The female reproductive system is also under the influence of menstrual cycle.

Structure of Female Reproductive System

The female reproductive system consists of following parts.

- i) Ovaries
- ii) Ducts
- iii) External genitalia

i) Ovaries

There is a pair of ovaries, which are oval-shaped and attached to the dorsal body wall just below the kidneys. Eggs or ova develop inside the ovaries of mature female. There are approximately **4,000,00 potential (follicles) cells** are already present at birth, only about 500 will ever become mature within two ovaries and they are released from puberty to menopause. Usually, only one egg is released every month. The ovaries take turn alternate to release an egg.

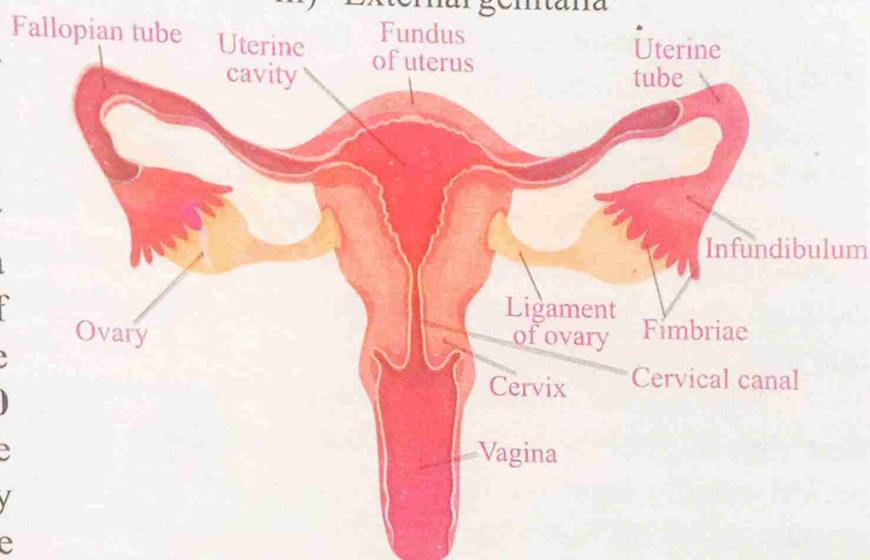


Fig. 20.5: Human Female Reproductive System

The egg is spherical in shape and about $120\mu\text{m}$ in diameter, containing a large nucleus with haploid number of chromosomes. (Fig.20.5)

ii) Oviduct (Fallopian tube or uterine tube)

The ovary releases mature egg into oviduct which is a narrow muscular tube. It leads from ovary to the uterus. The egg is fertilized in the oviduct.

Uterus

Uterus is a pear shape elastic sac about 7.5cm long. It is the site for development of fetus. During pregnancy, the wall of the uterus consists of three layers. The outer layer is called perimetrium, middle layer is myometrium which is thick and muscular. The inner layer is known as endometrium which is spongy lining of

Extra Information

Reproductive system contains the largest cell of the body the egg, which is about $120\mu\text{m}$ in diameter and smallest human cell the sperm, about $5\mu\text{m}$ in diameter.

uterus. At the lower narrow end of the uterus is a circular ring of muscle known as cervix.

iii) **External Genitalia (Vagina)**

Leading from the cervix to the outside is the birth canal or vagina. It is thin walled 8-10cm long tube. The opening of the vagina is the **vulva**. Semen is deposited in the vagina during intercourse.

Extra Information

A female uterus is normally about 3 inches long and 2 inches wide which can expand up to 20 times during pregnancy. Uterus contains one of the strongest muscles in the female body.

20.1.3 **Female Reproductive Cycle and its Hormonal Regulation**

The female reproductive system is controlled by the follicle stimulating hormone (FSH) and luteinizing hormone (LH) which are produced by pituitary gland. Their release is controlled by hypothalamus. FSH stimulates the ovarian follicles to produce estrogen, which helps in the maturation of egg while LH stimulates the production of progesterone in ovaries. The estrogen triggers the development of secondary sexual characteristics in female. The pituitary gland also produces **prolactin**, which stimulates milk production. The **oxytocin**, which stimulates uterine contraction during child birth and milk let down during sucking.

The start of monthly discharge of blood or menses from uterus via vagina is the first sign of puberty in female. This condition is called **menstruation**. The menstrual period usually lasts for five days. However, the length of the menstrual period and amount of blood lost vary considerably with the individual. Every month, a cycle of events takes place in the female reproductive organs. This is called **menstrual cycle**. The average menstrual cycle for an adult female is 28 days. However, the menstrual cycle ranging from 21-33 days, are not abnormal. The effects of emotional disturbances, stress, mental fatigue and illness may alter or stop the menstrual cycle. An unbalance diet or malnutrition may cause the periods to be very irregular or to stop completely. A young girl may take about three years before her periods become regular.

The menstrual cycle has 4 phase:

Menstrual Phase

Menstruation is the elimination of the thickened lining of the uterus (endometrium) and blood from the body through the vagina. Menstrual fluid contains blood, cells from the lining of the uterus and mucus. The average length of this phase is 5 days.

Follicular Phase

The follicular phase starts on the stoppage of menstruation and ends with ovulation. The pituitary gland releases follicle stimulating hormone (FSH), which stimulates the ovary to produce about **5-20 follicles**. Each follicle houses an immature egg. Usually only one follicle will mature into an egg while the others die. The growth of

the follicles stimulates the lining of the uterus to thicken in preparation for possible pregnancy.

Ovulation Stage

Ovulation is the release of mature egg from the surface of the ovary. This usually occurs mid of the cycle, about 14th day of the cycle.

During the follicular phase, the development of follicle causes a rise in the level of estrogen. The hypothalamus in the brain recognizing these rising levels and releases a chemical called **gonadotropin releasing hormone (GnRH)**. This hormone stimulates the pituitary gland to produce raised levels of luteinizing hormone (LH) and FSH within two days, ovulation is triggered by the high level of LH. The egg is funneled into the fallopian tube and toward the uterus by waves of small hair like projections. The life span of the typical egg is only around 24 hours.

Extra Information

Fallopian tubes are about 12cm long and wide as a sewing needle.

Luteal Phase

During ovulation, the egg bursts out from its follicle, but the ruptured follicle stays on the surface of the ovary. For the next two weeks or so the follicle transforms into the

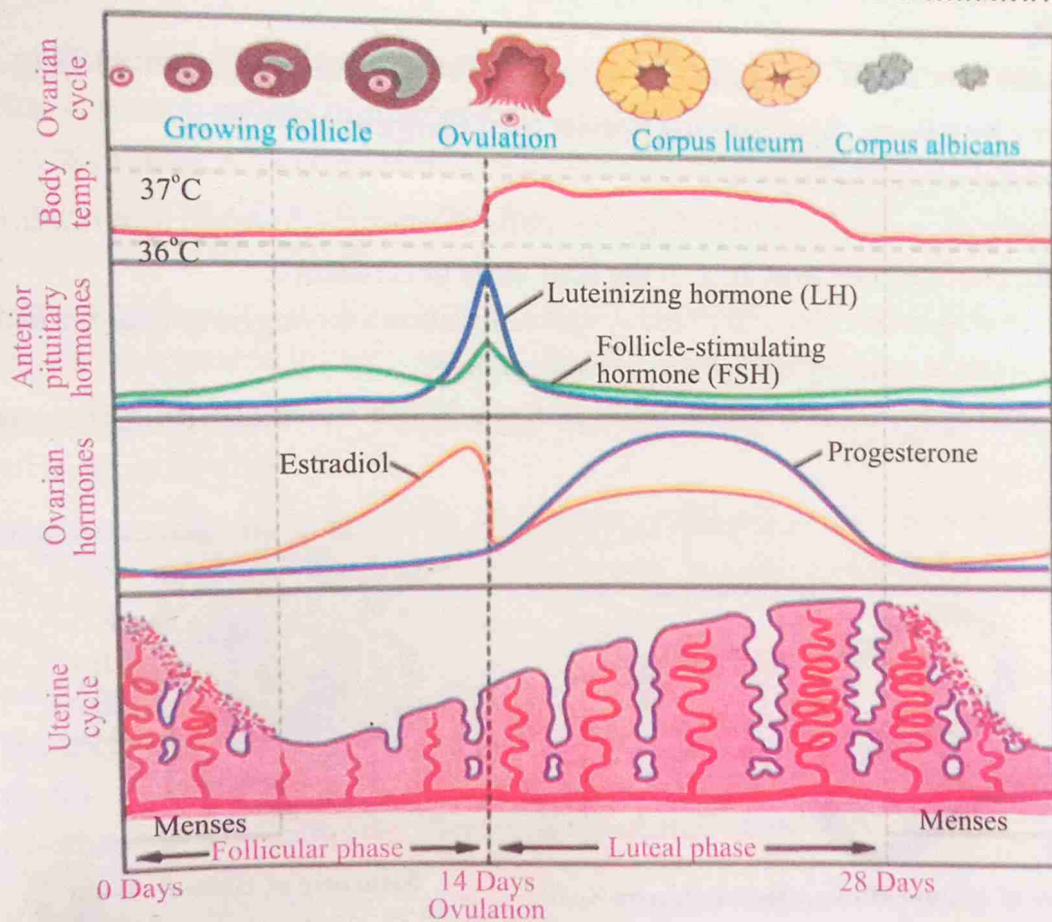


Fig. 20.6: Menstrual Cycle in Human

structure called **corpus luteum**. This structure starts releasing progesterone along with a small amount of estrogen. The combination of hormone maintains the thickened lining of the uterus of fertilized egg implants in the lining of the uterus. It produces the hormone that are necessary to maintain the corpus luteum. It induces the **human chorionic gonadotropin (hCG)**, the hormone that is detected in urine test for pregnancy. If pregnancy does not occur, the corpus luteum degenerates usually during day 22 after menstruation. The drop in progesterone level causes the lining of the uterus to fall away. This is known as menstruation. The cycle repeats. (Fig.20.6)

Extra Reading

Gametogenesis

- The production of gametes is known as gametogenesis.
- The process of gametogenesis occurs in gonads.
- The process of gametogenesis starts at puberty.
- There are two types of gametogenesis i.e. spermatogenesis and oogenesis.

Spermatogenesis

It is the process of sperm formation in male gonads (testes).

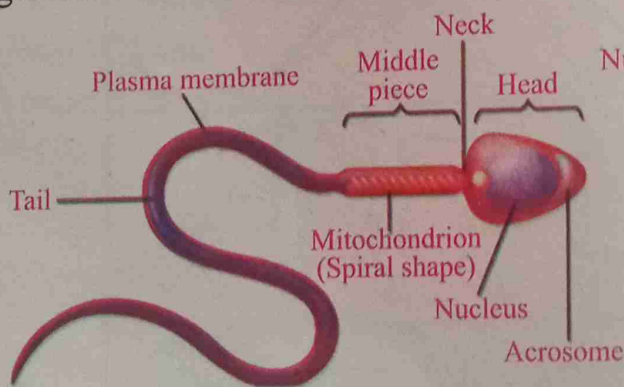
Oogenesis

It is the process of ova (eggs) formation in female gonads (ovaries). (Fig.20.7)

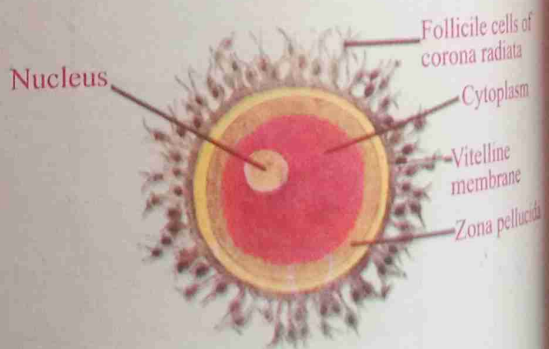
Differences between Spermatogenesis and Oogenesis

There are three differences

- In spermatogenesis all four daughter cells of meiosis develop into mature gametes while in oogenesis only one of the four cells gets mature.
 - Spermatogenesis starts at puberty and continuous throughout life while oogenesis also starts at puberty but ceases at menopause.
- Spermatogenesis is a continuous process while there are long interruptions in oogenesis.



Structure of Mature Human Spermatozoan



Structure of Human Ovum

Fig. 20.7: Structure of Sperm and Egg

Terms use for Human Ovum

Zona pellucida is thick transparent membrane surrounding a mammalian ovum before implantation.

Corona radiata is many layers' thick follicle cells adhering to oocyte which supply vital proteins to the cell.

Corpus albicans is regressed form of the corpus luteum.

20.3 Sexually Transmitted Diseases (STDs)

Sexually transmitted diseases are infections that are commonly spread by sexual activity. More than 30 different types of bacteria, viruses and parasites can be transmitted through sexual activity. Some examples of sexually transmitted diseases are chlamydia, gonorrhoea, syphilis, genital herpes, AIDS, etc. Here only gonorrhea, syphilis and AIDS will be discussed.

Gonorrhea

It is caused by the gram positive bacterium *Neisseria gonorrhoeae*. There is no blood test to diagnose gonorrhoea. In male, typical symptoms are pain upon urination and a thick greenish yellow urethral discharge. If a baby is exposed during birth, an eye infection leading to blindness can result. Gonorrhoea can spread to internal parts of the body, causing heart damage or arthritis. It is transmitted through direct contact or sexual contact. It is treated using antibiotics penicillin or tetracycline.

Syphilis

It is caused by a spirochete bacterium *Treponema palladium*. It has three stages, which are typically separated by latent periods. In the primary stage, a hard chancre (ulcerated sore with hard edges) appears. In the secondary stage, rash appears all over the body.

During the tertiary stage, syphilis may affect the cardiovascular and nervous system. It damages reproductive organs, eyes, bones joints, central nervous system, heart and skin. Sexual contact is the major source of its dissemination. Syphilis is a very devastating disease. Control depends on prompt and adequate treatment of all cases be treated with antibiotic therapy.

AIDS-A worldwide sexually transmitted disease

AIDS is caused by a virus called HIV (Human Immunodeficiency Virus). HIV destroys the body immune system. That is why this disease is called AIDS (Human Immune Deficiency Syndrome). The HIV attacks on specific type of white blood cells called T-cells. HIV may transmit through blood transfusion, contaminated syringes, surgical instruments, etc. However, the most prominent cause is sexual transmission. AIDS is a major global public health issue. There are approximately 38 million people living with HIV at the end of 2019. Over two thirds of all people with HIV infection live in African region (26 million). HIV can be diagnosed through rapid diagnostic tests. However, still there is no cure for AIDS.

List the measures that can help to prevent transmission of HIV.

The HIV is transmitted from one person to another by exchanging fluids of body. Therefore, following measures should be taken to prevent transmission because prevention is so far only cure for AIDS.

- Follow the Islamic teaching and refrain from immoral sexual activities.
- Avoid sharing instruments that are likely to break the skin and be contaminated with blood *e.g.* razors and tooth brushes.
- If you require acupuncture, ear, piercing, nose piercing, *etc.* You should go to reliable operators and make sure that needles used are sterilized or insist on using disposable instruments.
- Blood of donor must be screened before transfusion.
- Use disposable syringes and sterilized operation tools for surgery.
- Affected mothers must avoid breast feeding to their infants.